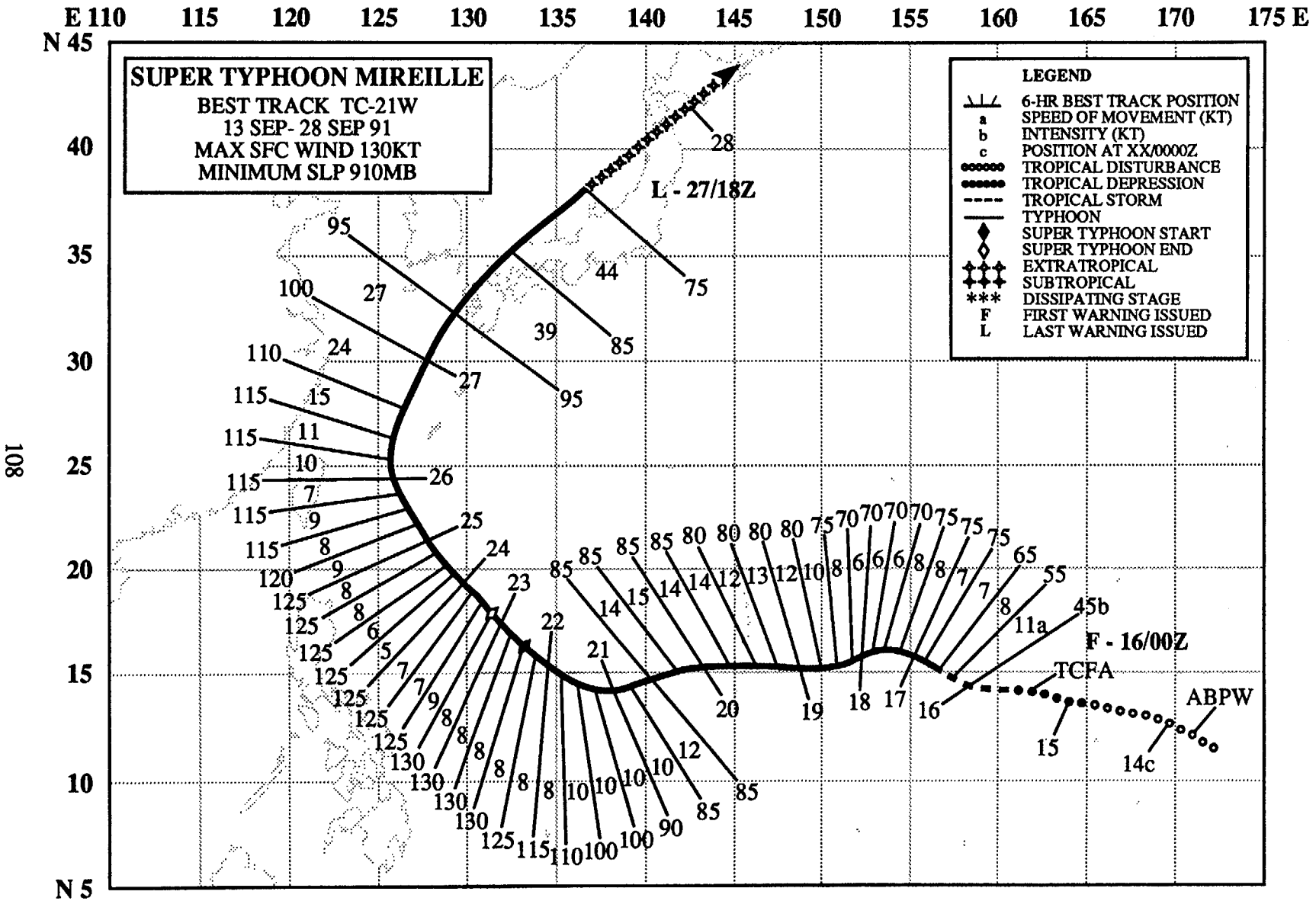
SUPER TYPHOON MIREILLE
BEST TRACK TC-21W
13 SEP- 28 SEP 91
MAX SFC WIND 130KT
MINIMUM SLP 910MB
LEGEND
6-HR BEST TRACK POSITION
SPEED OF MOVEMENT (KT)
INTENSITY (KT)
POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
L - 27/18Z
F - 16/00Z
TCFA
ABPW
E 110
115
120
125
130
135
140
145
150
155
160
165
170
175 E
N 45
40
35
30
25
20
15
10
N 5
108

SUPER TYPHOON MIREILLE (21W)

I. HIGHLIGHTS

The second super typhoon in the Northwest Pacific of the year, Mireille became the worst storm to strike Japan in three decades. Mireille outgrew its early midget size and reached super typhoon intensity several days before threatening Okinawa. Recurving just to the southwest of Okinawa, the typhoon accelerated, cutting a path across western Kyushu and Honshu. Then over the Sea of Japan, Mireille transitioned into an intense extratropical cyclone which slammed into northern Honshu. Mireille was part of a three storm outbreak in September - first with Tropical Storm Luke (20W) and Typhoon Nat (22W), and later with Typhoons Nat and Orchid (23W).

II. TRACK AND INTENSITY

Mireille was first detected as a poorly organized area of cloudiness in the monsoon trough over the southern Marshall Islands. The disturbance was first mentioned on the 130600Z Significant Tropical Weather Advisory. An increase in the amount of the tropical disturbance's deep convection prompted a Tropical Cyclone Formation Alert at 151200Z. Assuming normal development, forecasters issued the first warning for a 30 kt (15 m/sec) system at 160000Z. However, this was not to be a normal system. This was reflected in the 160600Z warning which upgraded the intensity to 45 kt (23 m/sec) and identified the system as very compact and rapidly intensifying. For several days the tropical system drifted to the west-northwest under the influence of the subtropical ridge. On the evening of 17 September, Mireille began to track to the west-southwest, creating some concern that it would target Guam, but 24 hours later the typhoon acquired a westward track and passed 12 nm (20 km) north of Saipan on 19 September as a midget typhoon. Then, on 21 September, the typhoon (Figure 3-21-1) began tracking to the northwest along the southwestern periphery of the ridge, and began interacting with Typhoon Nat (22W). This binary interaction (Figure 3-21-2) resulted in the temporary capture of the smaller typhoon, Nat, and its subsequent movement southward in the South China Sea. After releasing Nat, Mireille recurved under increasing southwesterly mid-tropospheric winds, and accelerated northeastward past Okinawa. Extratropical transition occurred in the Sea of Japan and the intense baroclinic storm continued northeastward, first passing over the extreme northern section of Honshu and then moving over southern Hokkaido.

The tropical cyclone initially peaked at 75 kt (39 m/sec) on 16 September and remained at moderate typhoon intensity until 21 September when it commenced a second deepening episode enroute to super typhoon intensity. This second episode was associated with decreasing upper-level wind shear from Tropical Storm Luke (20W) as that system weakened and accelerated northward. After peaking at 130 kt (65 m/sec) for a day (221200Z to 230600Z), Mireille began to slowly weaken.

Mireille's size, which was determined by the diameter of its outer-most closed isobar, began to gradually increase after an intensity of 80 kt (40 m/sec) was reached, and continued through extratropical transition.

III. FORECAST PERFORMANCE

As Mireille passed the Mariana Islands, it was difficult to determine how much the thin extension of the subtropical ridge would affect the cyclone's track. The first indications of a possible west-southwestward track excursion toward Guam came from the Beta Advection Models. OTCM also locked onto a west-southwest track after the turn had started. However, both FBAM and OTCM

overemphasized the southward excursion which lasted only a day.

After the system had passed the Marianas, recurvature forecasts were premature. The NOGAPS model underestimated the strength and duration of the subtropical ridge, and as a result all of the dynamic objective aids indicated early recurvature. The underestimation may have been the model's response to receiving three simultaneous tropical cyclone boguses in the basin corresponding to three storms. Also, the bogus, initializing the NOGAPS model, overplayed the size of Mireille, which in turn overemphasized the storm's weakening influence on the ridge.

IV. IMPACT

As Mireille approached the Mariana Islands, the wobble of its track and subsequent adjustment of the forecast to the north and back to the west, resulted in a flurry of disaster preparedness preparations on Guam northward through Saipan. When the midget typhoon passed north of Saipan, no reports of deaths or injuries were received. However, the island did suffer 70-80% crop damage, in addition to trees being uprooted, and coral roads seriously eroded. Most damage was confined to the north end of the island. Okinawa experienced 27 hours with winds greater than 50 kt (25 m/sec) and Kadena AB recorded a peak gust of 82 kt (41 m/sec). The island also recorded a total rainfall of 10.14 inches, and as a result, was able to cancel water rationing for the remainder of the

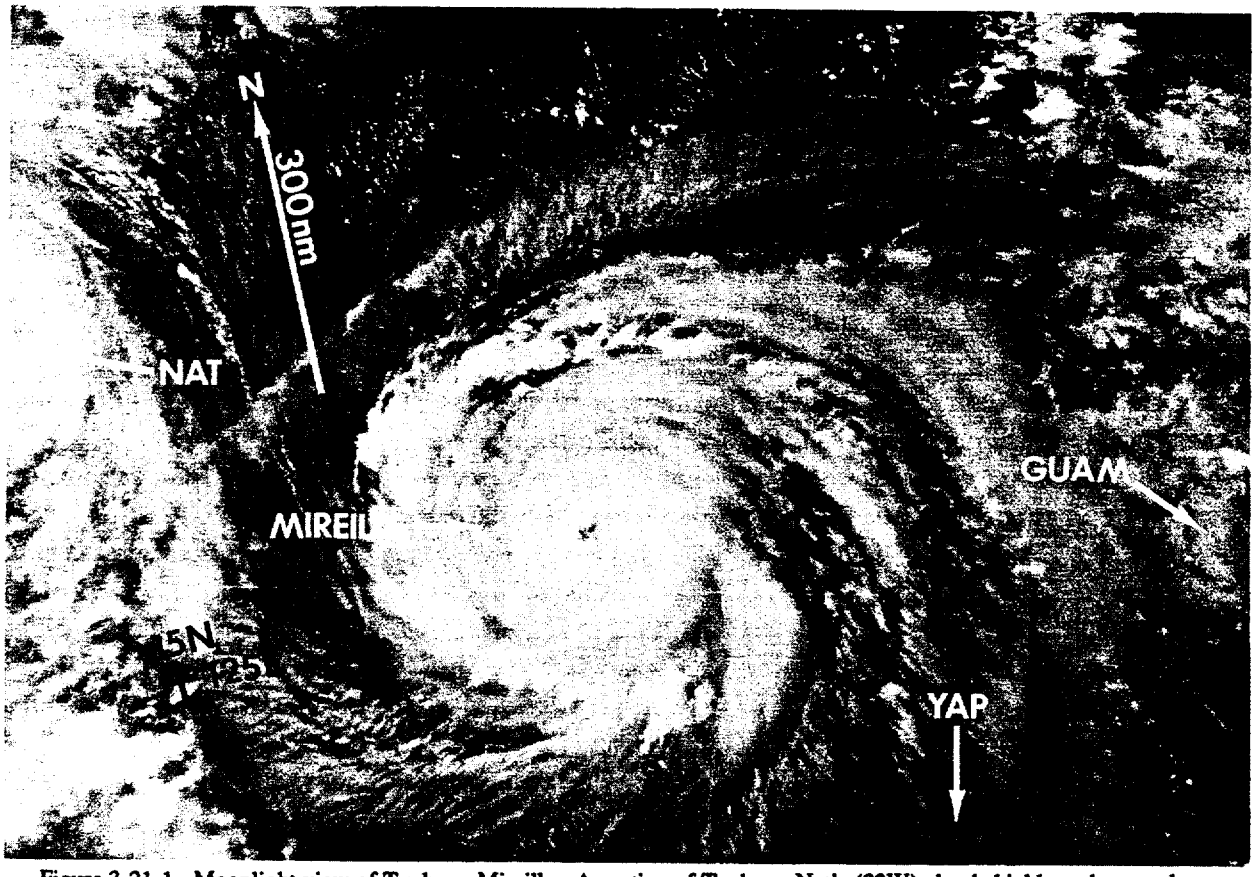

Figure 3-21-1. Moonlight view of Typhoon Mireille. A portion of Typhoon Nat's (22W) cloud shield can be see along the extreme left edge of the picture (221230Z September DMSP visual imagery).

year. Press reports from Japan indicated that 52 deaths were associated with the typhoon, including all ten crew members of a South Korean freighter that capsized while in port at Hakata on the island of Kyushu. Press reports also indicated 777 injuries, the flooding of approximately 10,000 homes, and power outages affecting nearly 6 million homes. Japanese crop damage was estimated at US$3 billion, with the apple crop being particularly hard hit. Nagasaki (WMO 47855) reported winds of 72 kt (37 m/sec) gusting to 118 kt (61 m/sec). On northern Honshu, Misawa AB recorded the most destructive winds since the U.S. started record-keeping for the base in 1946. For more than 5 hours the winds were 50 kt (25 m/sec) or greater and included a peak gust to 82 kt (41 m/sec). The previous all-time record for the base was 70 kt (35 m/sec) in March of 1987. The resulting wind damage was estimated to be between $0.5 to $1.5 million dollars. Several warehouse roofs were torn off, storage sheds were reportedly knocked off their foundations, and trees were blown down. The *Pacific Stars and Stripes* reported: "Base officials credit the Joint Typhoon Warning Center in Guam with early storm forecasts that allowed them to warn the base population and get million-dollar aircraft into hardened shelters."

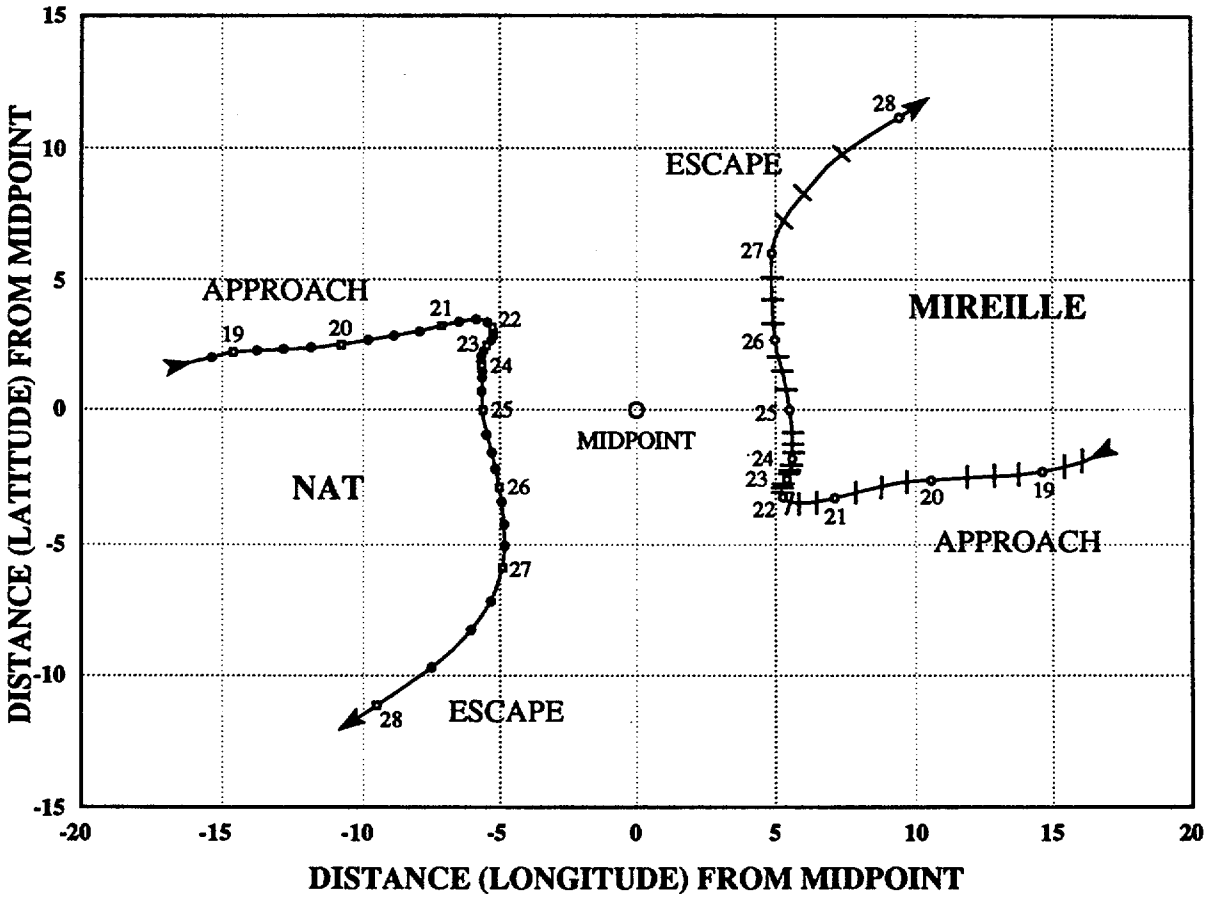

Figure 3-21-2. A plot of 6-hourly positions relative to the common midpoint shows the binary interaction between Typhoons Mireille and Nat (22W).